Technical and tactical factors to model success in rugby union.

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Technical and Tactical Factors to Model Success in Rugby Union

A Dissertation submitted to the University of Wales in fulfilment of the requirements for the degree of Master of Philosophy in Sport Science

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Abstract

The aim of this study was to analyse technical and tactical variables in relation to the tackle contest and try scoring in professional rugby union. Twenty-nine matches from the Domestic and European season of a professional male rugby union team were notated using a computerised analysis system. Thirty-seven performance indicators relating to technical and tactical components of the tackle contest and try scoring were identified through review of existing research literature and developed with two expert analysts from a professional rugby union team. Each performance indicator was compared between the case team and the opposition using Chi-Square test of significance and revealed statistical differences in tackle contest profiles, tries scored per phase, pitch location and behavioural origin of tries. For the tackle contest patterns were shown for 'going forward' ($p<0.001$), 'arm extended' ($p<0.001$) and 'inside/outside clean' ($p<0.001$) for the case team and their opposition. The case team scored more tries ($n=64$) than their opponents ($n=42$) during the Domestic and European season with more tries being scored during the first phase of play and less tries scored in the eighth phase. The case team scored and conceded more tries from lineout's, with the opposition scoring more tries from the yellow zone (50m–22m lines) on the field (24%). The findings highlight a number of factors that contribute to a successful tackle contest and to tries being scored for the case team. Analyses of technical indicators have shown that when the case team retains the ball at the tackle contest the attack was sustained and therefore, provide more scoring opportunities. However, in addition to keeping possession, it appears that the likelihood of scoring tries is associated with specific areas of the pitch in which behaviours occurred. The results of the tactical indicators have shown that playing within the attacking 22m goal line area increased the chance of tries being scored for the case team.

Declaration/Statements

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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Contents

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List of Tables

List of Figures

1. Introduction

Performance analysis research within rugby union has, to date, mainly been associated with describing patterns of play (e.g., Hughes & White, 1997; Eaves & Hughes, 2003) or the work-rates of individual players and their respective positions (e.g., Carter, 1997; Deutsch, Kearney & Rehrer, 2002). However, more recently research has focused on the examination of performance indicators (PIs) as predictors of success in the sport (e.g., Hughes & Jones, 2005; Prim, van Rooyen & Lambert, 2006). PIs are referred to as, 'a selection or combination, of action variables that aims to define some or all aspects of a performance' (Hughes & Bartlett, 2002; p. 739).

Existing studies of PIs in rugby union have tended to examine technical performance indicators (i.e., number of passes of play) and the characteristics of successful and unsuccessful teams/performances (cf., Ortega, Villarejo & Palao, 2009). Technical indicators in performance analysis are variables that show the level of success at performing a particular skill, such as percentage of lineout throws won/lost (e.g., Hughes & Franks, 2004). In contrast, tactics refer to the relative importance of teamwork and targeting the technical strengths and weaknesses of the team (Hughes & Bartlett, 2002). For example, PIs related to tactics assess whether patterns exist in attack and defence and how teams score. These can therefore be useful in identifying strengths and weaknesses in performance and inform match preparation. The importance of distinguishing between technical and tactical performance indicators has been highlighted in other team interactive sports such as soccer (Reep & Benjamin, 1968; Taylor, Mellalieu & James, 2005).

Rugby union is a complex and dynamic sport with the objective of the game is to score as many points as possible and to avoid conceding penalties (International

Rugby Board, 2003). There are several methods to score points in rugby union (i.e., tries, conversions, drop goals and penalties). However, in this study try scoring was examined as this represents the single highest points scoring method. Furthermore, previous studies (Jones, Mellalieu & James, 2004; Laird & Lorimer, 2004; Prim et al., 2006) have highlighted the importance of try scoring to success. Performance analysis is utilised frequently by teams seeking to gain advantage over their opponents and to score as many, or concede as few points as possible. However, there is a limited amount of research or coaching literature examining characteristics of try scoring and try scoring opportunities, especially with respect to the specific tactical behaviours that lead to these outcomes (Sayers & Washington-King, 2005). In a review of the International Rugby Board (IRB) statistics of try scoring Laird and Lorimer (2004) identified 75% of tries arose from possession gained within the opponents half and 39% from possession gained within the 22m line. Laird and Lorimer also reported a negative relationship between the number of passes made and tackles made to successful tries, supporting the idea that tackles and passes increase the chance of the ball being lost and hence a failure to score a try.

With regard to the technical aspect of performance, it has been suggested that the contact area of the game (i.e., rucks and mauls) is a key determinant of performance but has received little consideration in relation to try scoring (Wheeler & Sayers, 2009). Indeed Wheeler and Sayers identified that contact skills contribute significantly to the prediction of tackle breaks and the wide attacking patterns are associated with losing the ball, while van Rooyen, Diedrick and Noakes (2010) study of the 2007 World Cup pool stages found that greater number of rucks that a team created the more likely they were to win the game.

The findings of Laird and Lorimer (2004), together with the match characteristics described by Wheeler and Sayers (2009) and van Rooyen et al. (2010) do provide some indication of the factors associated with success in rugby (both with regard to winning matches and try scoring). However, a more detailed consideration of these PIs, particularly in relation to each other, to reveal successful tactics and strategies, is likely to provide greater insight into the mechanisms underpinning try scoring and subsequent success in rugby performance (e.g., comparing if tries from possession gained in a team's own half had more or fewer tackles/passes than tries scored from possession gained in the opponent's half). This can be further strengthened investigating spatial aspects of performance to determine if there are patterns in the locations from where points are scored and conceded.

Within this thesis, limitations of extant research will be addressed to model success in rugby union. In general, previous examinations of try scoring have focused on a specific performance characteristic or a limited selection of PIs (e.g., Laird & Lorimer, 2004) and therefore preclude a more holistic approach to the development of performance profiles. Therefore, the need to focus on the tackle area will be examined due to the notion that this is a determinant of success (Wheeler & Sayers, 2009). In addition, technical indicators (i.e., strength in tackle) will be considered in detail when tries are scored to see if one variable is used more than any other (i.e., going forward has higher frequency than static). By identifying these behaviours, teams are able to utilise these methods (i.e., moving forward in the tackle contest) to gain advantage over their opponents.

Given the highlighted limitations within the rugby-based research literature relating to try scoring the aim of the thesis was to examine the PIs, and subsequent performance profile, associated with success (tries scored) within professional rugby

union team. Specifically, this study examined trends from matches played by one single 'case' team against an aggregated data set consisting of their opponents. The case team approach provides a degree of control compared to aggregated data sets where there is a potential loss of any meaningful information due to each team possessing different styles of play, and consequently, diverse performance profiles (see Taylor et al., 2005). In contrast the aggregated dataset provides a method for cross validation of the performance profile of the case team and thereby offer some insight into the generalizability of the findings.

The first objective was to examine the key technical variable in rugby success, the contact area/tackle contest and the outcome of the tackle contest in relation to tries scored for a team compared to their opposition. Previous research that has examined the predictors of success within the tackle contest suggests that successful teams are more dominant at rucking (Stanhope & Hughes, 1997; van Rooyen et al., 2010). Therefore, based on the extant research literature it was hypothesised that each profile of the tackle contest for the studied team (e.g., strength in tackle, ball placement) will be identified as an important attribute in scoring tries against their opposition. Additional variables that can also contribute to a team's successful performance are possession (more possession the more tries would be scored) phases (more tries would be scored during 1-3 phases), team gainline (the more gainline made against the opponents the more likely a try can be scored) and speed of ball (quicker the ball in used from the tackle contest, there is an increased opportunity to score, (Lim, Lay, Dawson, Wallman & Anderson, 2011; Wheeler, Askew & Sayers, 2010; Eaves & Evers, 2007)).

The second objective of this thesis was to investigate tactical behaviours in relation to success in a rugby union team when compared to their opponents.

Specifically, the objective was to identify the location on the field where the try originated from (e.g. set-piece, open play), and whether the attacking team is more successful than the opposition in scoring tries from a particular area. In addition, the origin of possession will be analysed to assess whether tries are scored more from Lineout. Studies based on tactical behaviours have identified that teams tend to score more tries when gaining possession within the opponents half resulting in less phases to reduce the chance of error (Laird & Lorimer, 2004; Boddington & Lambert, 2004). Therefore, with the current study it was hypothesised that possession gained within the opposition half with limited amount of phases will be important in scoring tries.

2. Literature Review

2.1. Introduction

The aim of this chapter is to review the literature examining the performance analysis of rugby union. The review will firstly give a general overview on the performance indicators and how it is used within rugby union (section 2.2). Subsequent sections will discuss research in rugby union on the technical indicators in relation to the first objective the tackle contest (section 2.3) and tactical performance indicators on try scoring for the second objective in relation to pitch location and origin of possession (section 2.4). The chapter then concludes with a summary of the key issues discussed in preceding sections in relation to the thesis research question (section 2.5).

2.2. General Performance Indicators in Rugby Union

Although research in rugby union is largely based on work-rates of individual players, patterns of play and law changes, more recently it has been suggested that researchers should focus on the development of performance indicators to allow accurate performance profiling (Hughes & Bartlett, 2002). Hughes and Bartlett (2002) defined performance indicators as a variable, or combination of variables, aimed at defining some aspect of performance, and to be useful, should relate to a successful performance or outcome. Performance indicators can be divided into four categories: technical, and tactical indicators, match classification and biomechanical. Within this thesis technical and tactical indicators will be the main focus, as current performance analysis studies have not followed the guidelines in presenting this type of data (i.e., displaying the total frequency of all actions and present this data with the raw frequency or processed data, (Hughes & Franks, 2004)). Technical indicators

are variables that are used in isolation (Hughes & Franks, 2004) and indicate the level of success at performing a particular skill such as percentage of lineout throws won, missed tackles, successful passes and turnovers (Hughes, 2004). When presenting success rates the frequencies should be normalised against the number of occasions the skill was performed (Hughes & Bartlett, 2002). Tactical indicators or tactics refer to the relative importance of teamwork and targeting the technical strengths and weaknesses of a team. Tactical analysis can reflect the style of play the team are undertaking by assessing indicators such as field position and forms of possession (James, n.d.). The collection of technical and tactical indicators can be used to develop performance profiles (Hughes, Evans & Wells, 2001), which may provide a representation of future performances. Hughes et al. (2001) described a performance profile as a description of a pattern of a performance from the analysed team or individual. Performance profiles are typically created from collected frequencies of a combination of key performance indicators (Hughes et al., 2001). Vivian, Mullen and Hughes (2001) studied performance profiles in rugby union and suggested that individual skill profiles were suitable for comparison after five matches. Moreover, Hughes et al. investigated a number of samples required for a performance profile to be created and identified that between three and seven matches were needed to create true averages of the main behaviours. Although, it may appear that the larger database of matches to be analysed the more accurate the performance profile, but Hughes et al. identified that as the database increases in size the database becomes insensitive to the changes of playing patterns. However, if the database can become insensitive due to changes in playing patterns, other fluctuations of performance in rugby union such as strength of opposition, previous

performances and environmental conditions can have an affect (Hughes & Bartlett, 2002).

Table 1 summarise the studies that have attempted to analyse team performance profiles through the comparison of winning and losing teams. Hughes and White (1997) explored forward play in the Rugby World Cup 1991. Thirty-two matches from the World Cup were used to identify differences in patterns of play between successful and unsuccessful teams. Forwards of the successful teams were able to dominate the lineout through using more options (i.e., presenting the ball off the top of lineout or driven maul), stronger at rucking and mauling and technically better at scrummaging. Whilst the study reported reliability and statistical procedures, Bland and Altman (1986) have suggested that using correlation techniques are limited as a method for confirming acceptable reliability because correlation measures the strength between two variables not the agreement between them. Bland and Altman also reported that investigators try to compare two methods with a range of values therefore, a high correlation is almost guaranteed. Stanhope and Hughes (1997) also examined team performance profiles comparing winning and losing teams in the 1991 World Cup. It was reported successful teams were found to be more effective at rucking and kicking which resulted in more penalties being gained and therefore exploiting the poor defending of the unsuccessful teams.

A further study by Hunter and O'Donoghue (2001) attempted to examine offensive and defensive play of winning and losing teams in the 1999 World Cup. Significant differences in possession and methods used to gain territory were found between winning and losing teams when entering the last third of the pitch. In spite of this, further analysis is needed before predictions are made on playing behaviours because the research has compared two or more teams. As a result, each team may

possess different playing styles and therefore the data may not be consistent throughout the study. Early publications based on winning and losing teams (e.g. Hughes & Williams, 1988; Hughes & White, 1997) can lose important information by comparing aggregate data of two or more different teams. Jones et al. (2004) stated that when two or more teams are analysed the performance profiles could be varied, as each team possess different playing styles. To overcome this limitation winning and losing performances of a single team should be considered as the study by Jones et al. found a number of statistical and practical differences. For example, the study analysed 22 team performance indicators over 20 matches played by a professional male rugby union team. It was found statistically that tries scored, lineout's stolen and total turnover won had a considerable difference between winning and losing performances. By comparing winning and losing performances it can provide technical support to the team to improve performance as they can now optimize the amount of turnovers won and lineouts stolen per game.

Table 1: Summary of performance analysis studies examining successful and unsuccessful performances within rugby union

(Note X = Procedures not been discussed in study, √ = Procedures discussed in study)

Author (s) & Year	No. of Matches	Level of Play	Reliability & Validity	Statistical Procedures	Technical Indicators	Tactical Indicators	Main Findings/Conclusions
Hughes & Williams (1988)	5	Five Nations 1986-87	Reliability: X Validity: X	Statistics: X	Comparison of patterns of play. No specific variables mentioned.		• No differences between patterns of play of successful & unsuccessful teams. • Patterns of play differ with England & Wales compared with France, Scotland & Ireland.
Hughes & White (1997)	32	World Cup 1991	Reliability: √ *Inter, intra-observer* Validity: X	Statistics: √ *Chi-square t-tests*	Handling Kick Scrum Lineout Ruck Maul		• Forwards of successful teams dominate the lineouts by using more options (i.e., present the ball off the top, driven maul). • Successful teams are technically superior in scrums. • Successful teams are more dominant in rucks & mauls.
Potter (1997)	12	Five Nations 1992-94	Reliability: X Validity: X	Statistics: X	Kicks, Passes, Lineout, Scrum, Penalty/FK, Injuries, Drives, Ruck, Maul, Match time		• England succeeded playing a tight game away from home and playing more open at home with fewer errors.
Stanhope & Hughes (1997)	32	World Cup 1991	Reliability: √ *Inter, intra-observer* Validity: X	Statistics: X	33 variables divided into Set-piece, Scoring, Kicks, Mistakes, Actions		• Successful teams better at rucking, kicking and gaining more penalties. • Exploitation of unsuccessful teams' poor defending.

Hunter & O'Donoghue (2001)	22	World Cup 1999	Reliability: X Validity: X	Statistics: √ *Wilcoxon signed-rank test*	Event Time Outcome	Area of Pitch	• Winning teams entered the opposition 3rd on more occasions. • More attacks went around the opposition (wing zones).
Jackson & Hughes (2001)	8	Women's 6 Nations Canada Cup 1999/2000	Reliability: √ *Inter, intra-observer* Validity: X	Statistics: √ *Anderson-Darling test & non-parametric tests.*	Tackles, Passes, Kicks, Possession, Tackle Type, Rucking, Mauling		• Successful teams had higher pass per possession rate & tackle count. • Winning teams had greater number of players in each ruck & maul situation.
Potter & Carter (2001)	32	World Cup 1995	Reliability: X Validity: X	Statistics: X	Match time/Ball in play, Kicks, Passes, Lineouts, Scrums, Penalties, Rucks, Mauls, Turnover, Points		• Descriptive breakdown of behaviours from all matches. • During knock out stages, losing sides passed the ball more than the winners.
Jones, Mellalieu & James (2004)	20	Domestic Rugby Union 2002/03	Reliability: √ *Inter, intra-observer Percentage error* Validity: √	Statistics: √ *Confidence limits, Mann-Whitney U*	Scrum, Lineout, Ruck, Maul, Tackle, Offload, Turnovers, Kick, Tries, Penalties, Errors		• Winning performances had higher percentage success rates for rucks, mauls & turnovers. • Forwards of the winning teams were more dominant in lineout, rucking, mauling & turnovers.
Hughes & Jones (2005)	16	IRB World Sevens Series 2001	Reliability: √ *Inter observer Percentage error* Validity: X	Statistics: √ *Wilcoxon signed-rank test*	Ball in Play, Territory, Possession, Restart, Lineout, Scrum, Ruck, Maul, Passes		• Successful teams play with more width & more dominant in both defence & attack than unsuccessful teams.

2.3. Technical Performance Indicators in Rugby Union (Tackle Contest)

Table 2 highlights that over 50% of research based on performance indicators in rugby union are related to the contact area/tackle contest. However, as previously mentioned the measures used within the studies are varied and therefore difficult to make comparisons. Rugby union is known as a collision sport with high emphasis on contesting for the ball at the tackle contest (McKenzie, Holmyard, & Docherty, 1989). Many technical indicators of the tackle contest are a key determinant of performance such as the strength of contact, ball carrier going to ground, supporting players and speed of ball when tackle is complete (Sayers & Washington-King, 2005; Prim et al., 2006). Although the contact area is a fundamental aspect of performance within rugby union there is still a lack of published research on how the contact area can influence successful performance (Sayers & Washington-King, 2005). McKenzie et al. (1989) summarised the actions of the ball carrier and the importance of supporting players. It was identified that teams needed to carry the ball beyond the advantage line to dominate the tackle contest. While McKenzie et al.'s conclusions support coaching theory, it is important to note that the results were conducted on amateur sport and therefore may not extrapolate to elite performance. Sayers and Washington-King (2005) published similar findings in the Super 14 competition, which involved five teams from South Africa and New Zealand and four teams from Australia. The characteristics identified by the researchers were players that received the ball with greater intensity using stepping patterns were likely to dominate the tackle contest.

More recently Wheeler and Sayers (2009) have addressed technical indicators related to the effectiveness of the tackle contest based on modern day rugby. The findings suggested that tackle-breaks were achieved when the ball carrier had low

body height and strong leg drive. Conversely, when the ball carrier has high body height the opposition were more likely to turn over the ball at the breakdown. Therefore, it was concluded strong leg drive and low body height are effective characteristics of the contact area. The research has provided critical understanding of the contact area but the study does not identify contact skills relating to successful performance.

Further analysis has been conducted to identify if there is a relationship between ruck formation and success and failure of International/European rugby teams (van Rooyen et al., 2010; Smyth, O'Donoghue & Wallace, 2001). van Rooyen et al. (2010) reported that during the pool stages of the World Cup 2007 the greater number of rucks the team created the more likely the team would win the match. However, during the knockout stages the results were completely opposite with matches being won by teams forming fewer number of rucks. The researchers broadened their study by exploring tactical indicators (i.e., pitch location for where the ruck was formed). During the two stages of the competition the location of rucks differed. The frequency of rucks in the attacking half of the pitch decreased as the number of rucks in the defending half of the pitch increased throughout the knockout stages. van Rooyen et al. thought that these changes were due to the different abilities of teams during the knockout stages however, change in playing tactics could also have an effect. The results displayed were frequency data and using this approach alone may result in a loss of information being available (Hughes & Bartlett, 2002). By presenting a single set of data it can give unclear results on performance. For example if team A had 12 turnovers and team B had 8 turnovers, we could assume team B had a better game but, if team A had 48 possessions and team B had 24 possessions team A would be performing better because team A are

making errors once in four possessions whereas team B are making errors once in every three possessions. In summary, teams that are more dominant in the contact area appear to be more successful than their opposition. The few studies that have been conducted on the contact area (McKenzie et al, 1989; Smyth et al., 2001; Wheeler & Sayers, 2009) have not used consistent definitions (e.g., Smyth et al., 2001) investigated the time of contact and pitch location where as McKenzie et al. (1989) used broader terms on when players went into contact with the ball based on close or intermediate contacts) and therefore making comparisons between findings difficult.

Table 2: Summary of performance indicators from performance analysis studies within rugby union

(Note X = Procedures not been discussed in study, √ = Procedures discussed in study)

Author (s) & Year	No. of Matches	Level of Play	Reliability & Validity	Statistical Procedures	Technical Indicators	Tactical Indicators	Main Findings/Conclusions
McCorry, Saunders, O'Donoghue & Murphy (2001)	8	World Cup 1995 Knock-out stages	Reliability: X Validity: X	Statistics: X	Event time, Initiating team/player, Outcome	Area of Pitch	• Descriptive statistics - frequencies of behaviours e.g., positive & negative actions carried out in opposition's final third.
Parsons & Hughes (2001)	Not Reported	European Club 1999/2000 6 Nations Cup 1999	Reliability: √ *Intra-observer* Validity: X	Statistics: √ *Mann-Whitney U*	Number of Attacks, With/Without Ball, Hand Game, Feet Game, Run Game, Ball Retention, Defence, Attack, Tackler/Supporter, Recovery of Ball		• 'With ball' & 'without ball' activities of the different playing positions are different. • Certain roles evident for specific positions.
Sasaki, et al. (2002)	9	Japan World Cup 1999 Qualifiers	Reliability: X Validity: X	Statistics: √ *Correlation coefficient Un-named significance test*	Passing, Kicking, Individual gain, Running, Maul, Ruck		• Contributing factors to successful attacks 'individual gain', 'passing', 'making ground' & distances of 'individual running gain' & 'kicking gain'.
Jones, Mellalieu, James & Moise (2004)	12	6 Nations Tri Nations 2001-2002	Reliability: √ *Intra- observer Percentage error* Validity: X	Statistics: √ *Percentage ratios Chi-square*	Leg/Waist Tackle, Gainline, Offload		• Sothern hemisphere teams improved pattern of play by offloading in tackle to have high tempo game. • Northern hemisphere play is slower and defensive in nature.

James, Mellalieu & Jones (2005)	5	European Rugby Union 2001-2002	Reliability: √ *Inter, intra-observer Percentage error* Validity: √	Statistics: √ *Confidence limits, Chi-square*	Tackles, Carries, Passes, Tries, Penalties, Turnovers		• Differences observed between individuals within all tested playing positions for successful carries, passes, kicks & tackles.
Sasaki, et al. (2005)	10	Under 21 World Cup 2002	Reliability: X Validity: X	Statistics: √ *Multiple regression analysis.*	Turnovers, Time, Tackle, Loose ball possession, Counter attack, Pass.		• 'Upper teams' turned ball over on more occasions, more gains & more points from turnovers. • Teams should create systematic turnover play to get points.
Sayers & Washington-King (2005)	48	Super 12 2003	Reliability: X Validity: X	Statistics: √ *Spearman's Rank, Chi-Square, Mann-Whitney U*	Ball carries, Running activities, Game line activities, Phase outcome		• Top & bottom ranked teams have same qualities of contact effectiveness & positive phase outcomes. • Ball carries more effective using oblique or angled running patterns.
Prim, van Rooyen & Lambert (2006)	9	Super 12 2005	Reliability: √ *Intra-observer Percentage error* Validity: X	Statistics: √ *ANOVA, Confidence limits, Kruskall-Wallis*	Recycle time, Fast ball Unsuccessful tackles, Offloads Turnovers		• No differences between performance parameters or contact area of the four South African teams.

Quarrie & Hopkins (2007)	26	Bledisloe Cup 1972-2004	Reliability: X Validity: X	Statistics: √ *Linear modelling procedure*	Scrum. Ruck, Maul, Tackles, Lineout, Passes, Kicks, Scores, Penalties		• Introduction of professionalism showed increases in passes, tackles, rucks, tries & ball in play-time. • Law changes & developments in analysis have contributed to changes associated with professionalism.
Jones, James & Mellalieu (2008)	20	European Team 2002-2003	Reliability: √ Validity: √	Statistics: √ *Inter-quartile range*	Scrums, Lineouts, Ruck, Maul, Tackles, Kicks, Offload, Breaks made, Turnover, Penalties/error, Possession		• Form chart gives instant data concerning performance of each indicator. • Assess if a good or poor performance by 1 team affected the other team. • Drop in relative performance in some PIs due to hard-fought tackle contest. • Team 1 better than team 2 even though team 2 raised the game.
Van Rooyen, Rock, Prim & Lambert (2008)	7	Vodacom Cup 2006	Reliability: √ *Inter, Intra-observer* Validity: X	Statistics: √ *Frequency*	Open play contact, Ground Contact, Scrum/Lineout impact contact, Ruck/Maul contact		• Difference between number of contact situations forwards & backline players involved in. • More impact contacts per match when team lost.

Wheeler & Sayers (2009)	7	Super 14	Reliability: √ *Intra-observer* Validity: X	Statistics: √ *Kappa, Chi-Square, Standard Residual, Binary Logistic Regression*	Defensive Position at contact, Contact Intensity, Fend, Attacking Pattern of Play, Attacking Outcome		• Contact skills contribute to prediction of tackle-breaks. • Attacking ball carries turned over at breakdown when ball carrier has high body height. • Wide attacking patterns associated with losing ball within 3 passes. • Strong leg dive, low body height & active fending of defensive opponents effective contact skills.
Van Rooyen, Diedrick & Noakes (2010)	61	World Cup 2007 6 & Tri Nations 2007	Reliability: √ *Intra-observer Percentage Error* Validity: X	Statistics: √ *Frequency, Percentages*	Ruck (definition by IRB) Possession maintained or lost	Location on the field	• Greater number of rucks team creates the more likely to win match. • Not effective during knockout stages of rugby world cup, avoidance of rucking was associated with success.

2.4. Tactical Performance Indicators in Rugby Union (Try Scoring)

As highlighted in the previous section performance indicators related to the tackle contest, lineouts and turnovers are seen as the main area for team success. Ultimately, however, for the team to be successful they need to score more points than their opponents, as this is the principle aim of rugby union (IRB, 2008). Thomas (2004) reported the trends of how teams have been scoring points over the past six decades from 1954 to 2004. His study noted that in the past ten years dramatic changes have occurred from teams scoring tries, penalties and drop goals per match. During 1994 the majority of points scored were from penalty goals and the method with the lowest frequency was tries scored. But with the IRB changing many rules to make the game more expansive and exciting to watch the scoring trend changed in 2004 with tries being recorded as the highest form of scoring points per match and penalty goals being the lowest per match.

The IRB (2003) provided a review of all tries scored during fixtures between the top ten international sides. The highest proportion of tries were created from possession at their own lineout (50 tries), followed by own possession at scrum with 22 tries and opponents kick with 21 tries. However, when analysis was conducted the opponents handling error and turnover were divided in two separate categories, if we were to combine the two categories then turnovers would have a total of 27 tries. Laird and Lormier (2004) examined the IRB review of rugby in 2003 to compare their findings in relation to previous statistical analysis studies. Seventy-five percent of tries came from possession within the opponents half with 39% of the tries examined came from possession gained within the opponent's 22m zone. It would be expected that majority of tries would come from the opponents 22m zone as it is closer to the try line, more research would be required to identify whether possession

has come from scrum, lineout, turnovers or kick reception. A further statistic Laird and Lorimer discussed was that 48% of the tries scored had three phases or less, concluding that the more passes used in a move will more likely result in and error and no try being scored.

Boddington and Lambert (2004) also investigated field position and scoring opportunities of the South African team during the 2003 Rugby Union World Cup. The system adopted was based on a grid with the correct field dimensions and the ball movements were then plotted on the grid. The marked areas indicated where the points were scored from where the movements began, and the distance the ball moved across the pitch. Boddington and Lambert found that 86% of tries began within the opposition 25m area with 65% of those tries starting from the two wing zones.

Previous research has not provided in-depth analysis into the nature of try scoring, with the majority of studies examining pitch location, number of passes and possession time in relation to scoring points (Table 3). Lim et al. (2011) examined try scoring further using Team Attacking Superiority (TAS) scoring system to identify if consecutive periods of attack could predict try scoring within rugby union. Lim et al. analysed nine games from the Super 14 league from 2006 to 2008. Even though this study used more complex methods to predict try scoring, similar results were found to previous research in that 67% of try scoring occurred from three TAS periods or less. These results agree with the findings of Laird and Lormier (2004). However, Lim et al. noted that while teams would find it easier to score with lower number of TAS periods, the likelihood of converting these periods into points increase with more TAS periods than the attacking team can sustain.

Overall, the existing literature has identified that majority of tries are scored from the opponents' 22m from lineout and turnover. However, the literature has identified where tries are scored from there is limited research into the specific technical and tactical characteristics of try scoring. For example number of phases for a try to be scored and the events that lead to tries being scored such as the effectiveness of the tackle contest.

Table 3: Summary of performance analysis studies relating to try scoring within rugby union

(Note X = Procedures not been discussed in study, √ = Procedures discussed in study)

Author (s) & Year	No. of Matches	Level of Play	Reliability & Validity	Statistical Procedures	Technical Indicators	Tactical Indicators	Main Findings/Conclusions
Boddington & Lambert (2004)	5	Rugby World Cup 2003	Reliability: X Validity: X	Statistics: √ *Chi-Square, t-test*	[redacted]	Field position Where points were scored Movement preceded the scoring opportunity Direction the ball moved	• Scoring opportunity on right side of field between halfway line & the opposition 25m line. • Moved the ball right to left direction.
Laird & Lorimer (2004)	32	IRB National Teams 2003	Reliability: X Validity: X	Statistics: X	No of passes preceding a successful try The point in time a try is scored during the game	Position on field	• Players should minimise amount of time spent in half of field. • Passes & tackles increase chance of an action failing to result in score.
Sasaki et al. (2007)	198	Japanese Domestic Season 2003/05	Reliability: √ *Intra-observer, Percentage Error* Validity: X	Statistics: √ *Kruskal-Wallis Chi-Square, Man-Whitney U*	Lineout, Scrum, PK/FK, Phases, Passes for try	Source of Tries, Start area for try	• Scrums & lineouts common source of tries. • Winning teams scored more tries by tackle turnover.

Wheeler, Askew & Sayers (2010)	7	Super 14 2006	Reliability: √ *Inter, intra-observer* Validity: √	Statistics: √ *Kappa Chi Square*	Attacking Running Pattern Change of Direction Angle Defensive Pattern	Try Outcome	• Tackle-breaks, line-breaks, & offloading in tackle promote try-scoring ability. • Tackle-breaks strongly associated with team success.
Lim, Lay, Dawson, Wallman & Anderson (2011)	9	Super 14 2006-08	Reliability: √ *Verusco Technologies Ltd reviews the coders* Validity: √	Statistics: √ *Logistic regression*	Tries, Penalty kicks, Drop Goal, Kicking, Offload, Ball Placement, Attack Support, Set-piece, Tackle, Turnover		• TAS scoring system predict try scoring. • Easier for team to sustain attacking dominance over lower number of TAS periods. • Chance of converting periods of possession into tries increase based on more TAS periods team can sustain.
Diedrick & van Rooyen (2011)	11	International Rugby 2007	Reliability: √ *Intra- Observer* Validity: X	Statistics: √ *Chi- Square*	Line break Time Score	Pitch location	• Half of line breaks resulted in try. • Winning teams scored majority of tries from line breaks. • Line breaks occurred in midfield. • Line breaks important for successful performance.

2.5. Summary

This review has discussed performance analysis research within rugby union, specifically technical (tackle contest) and tactical (pitch location) indictors. To date, research has not examined the technical and tactical indictors to identify those variables associated with successful performance (i.e., try scoring). This review has highlighted that the tackle contest is considered a key technical factor in rugby performance yet has received limited detailed examination. In particular, the strength of contact, ball carrier going to ground, supporting players and speed of ball are all fundamental skills that can influence the performance of the tackle contest. Although the existing research has provided technical information regarding the tackle contest it has not analysed the tackle contest in relation to successful performance. In addition, there are a number of methodological issues with the current research, such as the type of statistical analysis and the procedures used to conduct the studies, this making it difficult to make accurate comparisons between the research findings.

In relation to try scoring, research has identified the majority of tries are scored from the opponents' 22m line from lineout and turnovers. However, comparisons between studies are difficult because allocation of zones on the pitch vary. Combining numerous aspects of rugby union within this thesis (tackle contest and try scoring) will allow for the identification of potential variables within these areas (e.g. strength of contact) that characterise successful performance. Further, existing studies have been limited by aggregating data sets of different teams rather than analysing one team's success and failure. Studies that have combined a number of teams to assess winning and losing performances (e.g., Hughes & White, 1997; Hunter & O'Donoghue, 2001) can result in a loss of meaningful information due to each team having different playing styles and consequently, varied performance

profiles (Taylor et al., 2005). Jones et al. (2004) overcame this limitation by comparing winning and losing performances of a single team and found a number of significant statistical and practical differences. Therefore, during this study conducting the analysis using a single team against their opposition will allow the greater insight and allow findings to be cross validated (e.g., identifying whether the case team scores and concedes in the same manner as their opposition).

3. Methods

3.1. Design

The commercial digital video analysis system 'SportsCode Elite' (Sportstec, 2011) was used to analyse professional rugby union matches from a single team competing in the Domestic and European competition during the 2010/2011 season. This was achieved in three stages. The first stage involved the identification of technical team performance indicators related to the tackle contest and a list of valid tactical team performance indicators to examine how tries are scored. Elite rugby union performance analysts (n=2) with over ten years experience were then asked to check/amend and add to the list if needed. Next, the match data was captured using a coding window (Figure 1) that was able to convert the specific behaviours into figures. This enabled comparisons between team's possessions resulting in tries scored versus possession not resulting in tries being scored. The tries conceded by the case team were also analysed. Finally, statistical techniques were employed (section 3.9) to investigate whether distributions of variables differed between the case team and their opposition and also between key technical/tactical variables (e.g., number of phases and tries scored, tackle contest profiles, speed of ball profiles, gainline profiles, turnover profiles, penalty/free kick profiles and origin of possession and pitch location).

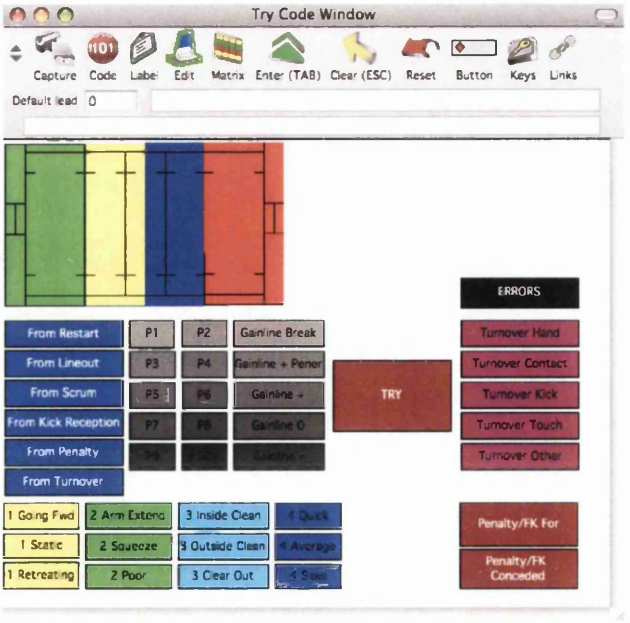

Figure 1: Coding window used to analyse the tackle contest and tries scored

3.2. Participants

Twenty-nine matches played by a professional rugby union team from Domestic and European competition in 2010/2011 season was used for the study. This included 14 home and 15 away games, with the case team winning 15, losing 13 and drawing 1. The team scored a total of 681 points and conceded 549, averaging 23 points for and 19 against. Team members ranged in age from 18 to 38 years (mean=25.7 years, standard deviation=4.72). Fifty-five percent of the case team squad had represented their country at international level with a sum of 926 caps. Before the study began consent was given by the team's Director of Coaching to use the footage and ethical approval was gained from the Swansea University Sport and Exercise Science Research Ethics Committee.

3.3. Measures

3.3.1. Identification of Technical Performance Indicators

Identification of technical performance indicators was undertaken via a four-step process. Initially, a list of rugby union technical performance indicators was generated using prior scientific publications related to successful/unsuccessful performances in rugby union (Table 1) and rugby-specific performance indicators (Table 2). This list was then discussed with performance analysts from the case team (n=2). The purpose of the list being discussed with the analysts is that expert knowledge is used to develop the system so that collected data is relevant and problematic areas such as the tackle contest are identified and operational definitions outlined. To ensure that the coding of behaviours was consistent, operational definitions for each performance indicator were created (Partridge & Franks, 1989). Next, after establishing the relevant performance indicators, the list was presented to the research supervisors and analysts to validate and add to the list if required. The research supervisors and analysts also verified the operational definitions and amended where appropriate. Complete lists of performance indicators are shown in Table 4.

Table 4. Technical performance indicators and operational definitions

Technical Indicators	Operational Definitions
Gainline Break	Carrier has made a clean break through the defensive line.
Gainline + Pener[1]	Carrier has made a break around the defensive line.
Gainline +	Carrier has gained ground from when the previous phase occurred.
Gainline 0	Carrier has not gained or lost ground from when the previous phase occurred.
Gainline -	Carrier has lost ground from when the previous phase occurred.
Going Forward	The ball carrier gains a dominant position over the defender when tackled irrespective of team gainline.
Static	The ball carrier is tackled, neither the carrier or tackler gains a dominant position irrespective of team gainline. e.g. has been tackled in the same position of receiving the ball.
Retreating	The ball carrier is tackled and the defender gained a dominant position irrespective of team gainline.
Arm Extended	When the ball carrier is on the ground after being tackled is facing the attacking team and presents the ball at arm length away from the body to the same team.
Squeeze	Ball carrier going to ground usually keeping the body parallel to touchline, holding the ball to the chest, when on ground protecting the ball by pushing it back through the legs.

[1] Abbreviation Pener = Penetration

Poor	Ball carrier has not been able to present the ball cleanly for the acting scrum-half to pass the ball.
Inside Clean	The attacking player clearing the tackle contest on the inside. E.g. ball carrier been passed the ball from left, left is known as the inside.
Outside Clean	The attacking player clearing the tackle contest on the outside. E.g. the opposite side to where the ball had been received.
Clear Out	The attacking player has entered the tackle contest to completely take out a defensive player so they cannot compete for the ball.
Quick	The time it takes the acting scrum-half to move the ball away from the contact area - 0 seconds to 2.5 seconds.
Average	The time it takes the acting scrum-half to move the ball away from the contact area - 2.6 seconds to 6 seconds.
Slow	The time it takes the acting scrum-half to move the ball away from the contact area – 6+ seconds.
Try/Penalty Try	When an attacking player is first to ground the ball in the opponents' in-goal, a try is scored. Penalty try is awarded if a defender commits a professional foul against the ball carrier who is simultaneously scoring a try.

Indicators for possession entering the 22m not scoring a try due to an error

Possession entering 22 meter	Analysis begins from the 1st phase when the analysed team enters the 22m line in the direction of the teams attack (termed Zone Green, see Table 5).

Turnover Hand	Possession conceded due to handling error (e.g. Knock on, Forward Pass).
Turnover Contact	Possession conceded in contact (e.g. Jackal, 1 on 1 Rip, Knock on in tackle, Includes Ruck Lost).
Turnover Kick	Possession conceded due to kicking error (e.g. Charge down, Out on Full (in touch / Dead), not retrieving own kick.
Turnover Touch	Player in possession of the ball has been tackled or run into touch.
Turnover Other	Lost possession by interception, accidental offside or losing the ball through other means which have not been mentioned above.
Penalty/FK For	When the opposition has committed the infringement and the analysed team is given possession of the ball.
Penalty/FK Against	When the analysed team has committed the infringement and the opposition is given possession of the ball.
Phase 1, 2, 3, 4, 5, 6, 7, 8, 9, 10+	A phase is known as a unit of play, this is the period of play extending from re/start of play until the next breakdown in play, which can either be a ruck, maul or end of play.

3.3.2. Identification of Tactical Performance Indicators

Specific tactical performance indicators were firstly listed using prior scientific rugby union publications related to try scoring in rugby union (Table 3). The process of validating these measures was carried out in the same way as that of the identification of the technical indicators (section 3.3.1). Complete lists of tactical performance indicators are shown in Table 5.

Table 5. Tactical Performance Indicators and Operational Definitions

Tactical Indicator	Operational Definition
Zone 4 Red	The analysed teams possession began from their try line to 22m before entering the opposition 22m or scoring a try.
Zone 3 Blue	The analysed teams possession began from their 22m line to ½ way before entering the opposition 22m or scoring a try.
Zone 2 Yellow	The analysed teams possession began from the ½ way line to attacking 22m before entering the opposition 22m or scoring a try.
Zone 1 Green	The analysed teams possession began from the attacking 22m line to the try line.
From Restart	The analysed team received possession from when the opposition kicked a restart that occurs at the start of each half and after a score or touch down.
From Lineout	The analysed team received possession from a lineout. Lineout is a set-piece where the hooker throws the ball into play between a row of players from each team after the ball has gone into touch.
From Scrum	The analysed team received possession from a scrum. Scrum is a means of restarting play after a minor infringement. It involves eight players from each team, interlocking.
From Kick Reception	Occurs when a player receives the ball from a kick by the opposition.
From Penalty	The analysed team received possession when the opposition conceded a penalty under pressure.
From Turnover	The analysed team received possession when the opposition lost the ball in open play.

3.4. Pilot Study

A pilot study was conducted to assess the validity and reliability of the developed computerised notation system. Thomas and Nelson (1996) outline that by conducting a pilot study problems can be corrected and an increase in knowledge of the system will be gained. For this purpose, a single match from the domestic season of the case team that was not involved in the full analysis was used to examine the PIs to ensure all operational definitions were understood and clear for the reliability testing.

When the initial design (Figure 2) of the coding window was tested the diagram of the pitch highlighted inconsistencies, as it was difficult to see where one zone started and finished. This was overcome by changing the colours of the zones as shown in Figure 1. Other changes that were made from the initial design is that 'Penalty Try' code button was not needed, therefore penalty tries and tries were coded as 'TRY'.

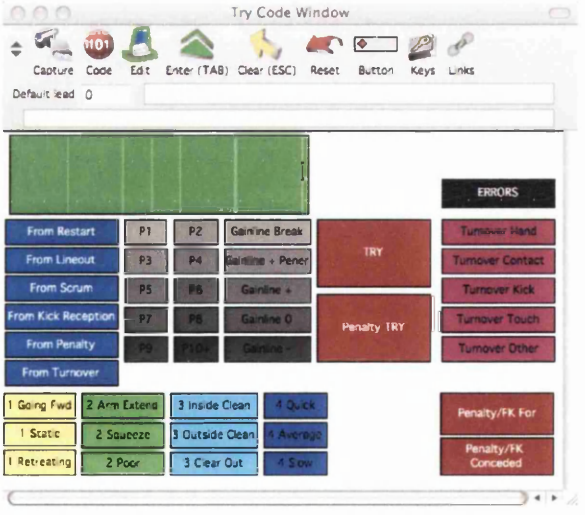

Figure 2: Initial design of the coding window.

3.5. Hardware and Software

The 'SportsCode' digital video analysis system for Apple Macintosh was used to code (coding window Figure 1) all the observed instances of the identified performance indicators. The 29 pre-recorded rugby union matches were stored on a

'Western Digital My Passport' external hard drive (500GB) within the College of Engineering, Swansea University. Apple Macintosh Version 10.6.8, Microsoft Office 2008 (Microsoft Corporation, 2008) and SPSS Statistics Version 19 (SPSS Inc, 2010) were used to complete full statistical analysis.

3.6. System Reliability

Reliability is defined as the consistency of measurements, or of an individual's performance, on a test (Atkinson & Nevill, 1998). Reliability analysis was conducted to ensure the system is acceptable and working correctly. Inter- and intra-observer reliability was performed to ensure the accuracy and consistency of data entry. The author completed intra-observer reliability on two occasions, separated by a seven-day period. Inter-observer reliability followed a similar procedure, but the author and an experienced rugby notational analyst coded the sample match. Data was then exported into frequency tables from 'SportsCode', which enabled errors to be identified. The data was compared using the calculation percentage error (Hughes, Cooper & Nevill, 2002) with a 5% error level, which has been deemed acceptable for each variable (Atkinson & Nevill, 1998).

3.7. Procedure

The analysed team's matches were recorded in MP4 format; all footage from the Domestic and European competition was transferred to a 'Western Digital My Passport' external hard drive (500GB). From the original footage, selected instances (tries scored and possession into the 22m) were exported from each match creating two databases. This process removed the unwanted movie data and compiles all the information needed into a separate file. All matches were then viewed and coded using the selected performance indicators in 'SportsCode'. The software

'SportsCode' enabled the analyst to code observed behaviors using single key presses (e.g., From Restart). However, for the more detailed analysis several codes could be used simultaneously (e.g., if the team started a phase and went into contact, the phase number was input followed by the descriptors for the tackle contest). Once all the footage was coded the data was exported into 'Microsoft Excel' (Microsoft Corporation, 2008) for initial review and SPSS 19 (SPSS inc, 2010) was used for statistical analysis.

3.8. Data Analysis

Technical and tactical indicators were presented as frequency data and percentages for comparisons between the case team and their opposition (Hughes & Bartlett, 2002). In addition, appropriate statistical analysis was conducted using chi-square tests of significance to make a comparison between performance indicators (only significant differences will be reported in the results section). The chi-square test examines the difference between the observed frequencies of events and the expected frequency of events (as calculated from the data). Specifically, the chi-square statistic (X^2) is given by $X^2=(O-E)^2/E$ where O is the observed frequency of an event and E is the expected frequency (Field, 2009). When calculating chi-square the expected frequencies in each category should be greater than 5 to have an accepted threshold of significance, performance indicators with values less than 5 have no association between the independent and dependent variables (Field, 2009). However, when the data sets are small or tables are sparse using chi-square alone may fail to produce accurate results. Therefore, to overcome these limitations, the Monte Carlo Test was used to simulate the chi-square statistic and associated significance level. The Monte Carlo Test provides an unbiased estimate of the exact p value (SPSS, 2010).

Where the chi-square test of significance resulted in a $p<0.05$, post-hoc examination of the standardised residuals ($O-E/\sqrt{E}$) was undertaken to identify where the specific differences were (see Field, 2009). Standardised residuals represent the error between what the model predicts (i.e., expected frequency) and the data collected (i.e., the observed frequency). Standardised residuals that have a positive value mean that the cell was over-represented in the actual sample compared to the expected frequency (i.e., there were more observations in a category than expected). Standardised residuals that have a negative value mean that the cell was under-represented in the actual sample compared the expected frequency (i.e., there were fewer observations in a category than expected). Standardised residuals greater than ±1.96 are significant at the $p<0.05$ level, standardised residuals greater than ±2.58 are significant at the $p<0.01$ level and standardised residuals greater than ±3.29 are significant at the $p<0.001$ level (Field, 2009). The use of standardised residuals represents an improvement on many previous studies where data were simply 'eyeballed' following a significant p value, with the researcher making assumptions about where the specific differences has occurred. Finally effect sizes were calculated for all chi-square tests using Phi ($\chi^2_{obt} / (N)(K-1)$). Where χ^2_{ob} is the obtained chi-square value, N is the total sample size across all categories and $K-1$ is the number of categories minus one. Phi was calculated where the association between the behaviour performed and the team performing the behaviour was being assessed while the methods outlined by Hinkle, Wiersma and Jurs (2003) were followed for the chi-square tests of independence (i.e. where the frequency of behaviour was being analysed within teams).

4. Results

4.1. Reliability

Reliability analysis indicated that for all variables the level of intra-observer agreement was 100%. Inter-observer reliability exceeded 98% for the frequency of variables. The variable of speed of ball had one discrepancy with one extra 'quick ball' notated. After discussions with the second coder it seemed that the quick ball button was accidently pressed as the average speed of ball had already been registered. Therefore, the system was deemed acceptable for the intended analysis. (see Appendix 1-4 for exported frequency tables relating to reliability results).

4.2. The Tackle Contest for Tries Scored

In the tackle contest (Table 6) the case team ($\chi^2(2)=161.1$, $p<0.001$, Phi=0.57) and the opposition ($\chi^2(2)=138.58$, $p<0.001$, Phi=0.54) had more players 'Going Forward' (case standardised residual: 10.22; opposition standardised residual: 9.53) and less players being 'Static' (case standardised residual: -3.64; opposition standardised residual: 3.78).

Differences were observed in 'Ball Placement' ($\chi^2(2)=208.62$, $p<0.001$, Phi=0.81) with players using the 'Arm Extended' method (standardised residual: 11.80) over 'Squeeze' and 'Poor' techniques (standardised residual: -5.96 and -5.82 respectively). This was replicated by the opposing teams ($\chi^2(2)=158.42$, $p<0.001$, Phi=0.63) with players' performing significantly more 'Arm Extended' ball placements (standardised residual: 10.27) over 'Squeeze' and 'Poor' placements (standardised residual: -5.22 and -5.06 respectively).

Differences were found at the 'Tackle Clearance' for the case team ($\chi^2(2)=117.64$, $p<0.001$, Phi=0.19) with players using the 'Inside' and 'Outside

Clean' method (standardised residual: 4.38 and 4.48 respectively) over the 'Clear Out' method (standardised residual: -8.86). The opposition also displayed the same pattern ($\chi^2(2)=117.21$, $p<0.001$, Phi=0.23) with greater 'Inside' and 'Outside Clean' (standardised residual: 4.26 and 4.58 respectively) and less 'Clear Out' (standardised residual: -8.84).

Table 6: Frequency and percentage of the incidences occurring in the tackle contest for tries scored by the case team and the opposition

Tackle Contest Profiles		Frequency of incidents preceding a try by the Case Team (% of overall incidents)	Frequency of incidents preceding a try by the Opposition (% of overall incidents)
Strength in Tackle	**Going Forward**	124 81%	105 82%
	Static	25 16%	18 14%
	Retreating	4 3%	5 4%
Ball Placement	**Arm Extended**	134 89%	108 87%
	Squeeze	8 5%	8 6%
	Poor	9 6%	9 7%
Tackle Clearance	**Clear Out**	12 4%	3 1%
	Inside Clean	145 48%	123 49%
	Outside Clean	146 48%	126 50%

4.3. Number of Tries Scored and Conceded per Phase

Differences were found for the case team (Table 7) between the amount of possession in each phase ($\chi^2(9)=139.77$, $p<0.001$, Phi=0.07). Specifically, more possessions in phase one (standardised residual: 9.00) and phase two (standardised residual: 4.08). Possession was less in phases seven, eight, nine and ten (standardised residuals: -2.76, -3.18, -3.40 and -2.33 respectively). Similar findings were found with the opposition's first and second phases (standardised residuals: 5.98 and 3.33 respectively) whilst phases eight, nine and ten (standardised residual: -2.94, -3.42 and -1.25) had less.

The number of tries scored by the case team differed in each phase ($\chi^2(9)=62.56$, $p<0.001$, Phi=0.11), with more tries scored in the first phase (standardised residual: 6.56) and less tries scored in phase eight (standardised residual: -2.13). Similarly, the opposition ($\chi^2(9)=21.33$, $p<0.05$; Monte Carlo Test, $p=<0.05$, Phi=0.06) scored more tries during the first phase (standardised residual: 3.32).

Table 7: Frequency and percentage of tries scored and conceded per phase by the case team and the opposition

	Case Team		Opposition	
	Frequency of Tries by phase (% Overall Tries)	**Possession (Tries scored/total phase possessions)**	**Frequency of Tries by phase (% Overall Tries)**	**Possession (Tries scored/total phase possessions)**
Number of Phases				
Phase 1	23 36%	23/64 36%	11 26%	11/42 26%
Phase 2	11 17%	11/41 27%	6 14%	6/31 19%
Phase 3	9 14%	9/30 30%	7 17%	7/25 28%
Phase 4	5 8%	5/21 24%	3 7%	3/18 17%
Phase 5	2 3%	2/16 13%	4 10%	4/15 27%
Phase 6	5 8%	5/14 36%	1 2%	1/11 9%
Phase 7	2 3%	2/9 22%	5 12%	5/10 50%
Phase 8	1 2%	1/7 14%	2 5%	2/5 40%
Phase 9	2 3%	2/6 33%	1 2%	1/3 33%
Phase 10+	4 6%	4/11 36%	2 5%	2/12 17%
Total Tries	***n*=64**		***n*=42**	

4.4. Gainline Type for Case Team and Opposition at the Tackle Contest

At the tackle contest for the case team (Figure 3) there were differences between the type of team Gainline ($\chi^2(4)=133.80$, $p<0.001$, Phi=0.16) with more 'Gainline +' (standardised residual: 9.27) and less 'Gainline + Pener' and 'Gainline –' (standardised residual: -4.98 and -4.51 respectively). Similarly, the type of Gainline differed by the opposition ($\chi^2(4)=86.97$, $p<0.001$, Phi=0.13) with more 'Gainline +' (standardised residual: 7.31) and less 'Gainline + Pener' and 'Gainline –' (standardised residual: -4.18 and -3.48).

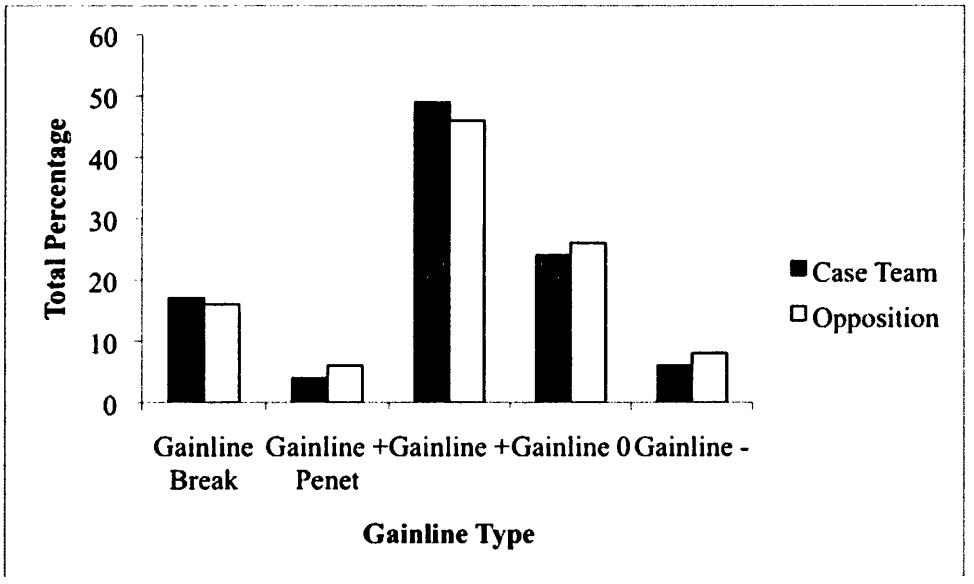

Figure 3. Total percentage for team gainline during each tackle contest that has resulted in a try being scored at the end of phase play for the case team and their respective opposition (Gainline = **Gainline Break** Carrier has made a clean break through the defensive line, **Gainline + Pener** Carrier has made a break around the defensive line, **Gainline +** Carrier has gained ground from when the previous phase occurred, **Gainline 0** Carrier has not gained or lost ground from when the previous phase occurred, **Gainline -** Carrier has lost ground from when the previous phase occurred).

4.5. Gainline Type at the Tackle Contest for Case Team and the Opposition by Phase

At the tackle contest during phase 1-3 for the case team (Table 8) there were differences between phase and Gainline type ($\chi^2(4)=78.55$, $p<0.001$, Phi=0.16). Specifically, more 'Gainline +' were observed (standardised residual: 7.07) and less 'Gainline + Pener' were performed (standardised residual: -3.29). This was replicated by the opposing teams ($\chi^2(4)=52.49$, $p<0.001$, Phi=0.14) with players using 'Gainline +' more (standardised residual: 5.58).

Phase 4-6 were similar to phase 1-3, with more 'Gainline +' for the case team and their opposition (standardised residual: 4.63 and 4.00 respectively). The pattern for phase 7+ was also found to be similar for the case team ($\chi^2(3)=12.25$, $p<0.01$, Phi=0.13) and the opposition ($\chi^2(4)=11.86$, $p<0.05$, Phi=0.10) with more 'Gainline +' (standardised residual: 2.83 and 2.57 respectively).

Table 8: Comparison of the case team and their opposition of team gainline made during each tackle contest that has resulted in a try being scored at the end of the phase play (frequency and percentage)

	Phase 1-3		Phase 4-6		Phase 7+	
	Frequency of line breaks by the Case Team (% of overall incidents)	**Frequency of line breaks by the Opposition (% of overall incidents)**	**Frequency of line breaks by the Case Team (% of overall incidents)**	**Frequency of line breaks by the Opposition (% of overall incidents)**	**Frequency of line breaks by the Case Team (% of overall incidents)**	**Frequency of line breaks by the Opposition (% of overall incidents)**
Gainline Break	22 65%	18 69%	7 21%	5 19%	5 15%	3 12%
Gainline + Pener	8 89%	6 67%	1 11%	1 11%	0 0%	2 22%
Gainline +	59 59%	43 57%	25 25%	20 27%	16 16%	12 16%
Gainline 0	28 57%	23 55%	13 27%	11 26%	8 16%	8 19%
Gainline -	4 33%	4 31%	5 42%	5 39%	3 25%	4 31%

4.6. Total Speed of Ball for the Case Team and Opposition when a Try is Scored

When the ball was recycled from the tackle contest (Figure 4) the case team showed differences between the types of speed of ball ($\chi^2(2)=37.02$, $p<0.001$, Phi=0.12) with less 'Slow' deliveries (standardised residual: -4.97). The opposition also performed less 'Slow' speed of ball (standardised residual: -3.05).

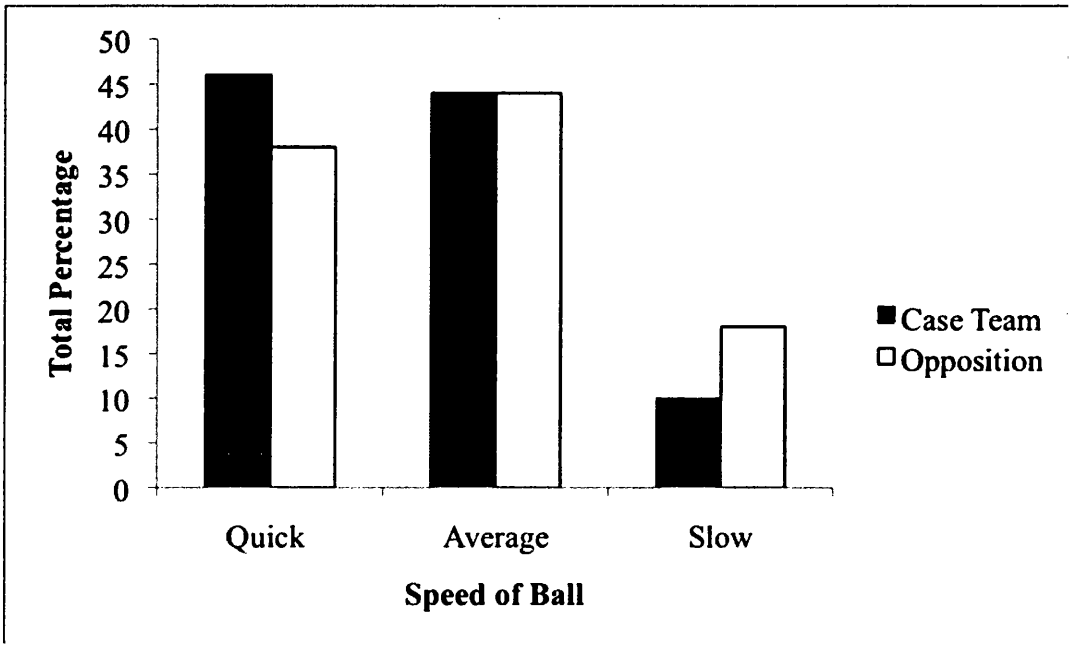

Figure 4: Total percentage for speed of ball during each tackle contest that has resulted in a try being scored at the end of phase play for the case team and their respective opposition (Speed of Ball = **Quick** 0-2.5 seconds, **Average** 2.6-6 seconds, **Slow** 6+ seconds).

4.7. Speed of Ball by Phase for the Case team and Opposition during Tries Scored

Table 9 shown that for the case team there were differences between phase and speed of ball ($\chi^2(2)=32.99$, $p<0.001$, Phi=0.18) with more deliveries with 'Quick' speed of ball (standardised residual: 3.58) and less deliveries with 'Slow' speed of ball (standardised residual: -4.41). However, the opposition only had one difference between their speed of ball during phase 1-3 ($\chi^2(2)=18.60$, $p<0.001$, Phi=0.13) with 'Slow' speed of ball having fewer deliveries (standardised residual: -3.51).

Table 9: Comparison of the case team and their oppositions' speed of ball during each tackle contest which has resulted in a try being scored at the end of the phase play (frequency and percentage)

	Phase 1-3		Phase 4-6		Phase 7+	
	Frequency of deliveries by the Case Team (% of overall incidents)	**Frequency of deliveries by the Opposition (% of overall incidents)**	**Frequency of deliveries by the Case Team (% of overall incidents)**	**Frequency of deliveries by the Opposition (% of overall incidents)**	**Frequency of deliveries by the Case Team (% of overall incidents)**	**Frequency of deliveries by the Opposition (% of overall incidents)**
Quick	50 70%	34 69%	14 20%	12 25%	7 10%	3 6%
Average	35 52%	32 56%	19 28%	17 30%	14 21%	8 14%
Slow	6 38%	7 30%	7 44%	7 30%	3 19%	9 39%

4.8. Errors by the Case Team Preventing Tries being Scored

The case team committed 126 errors within the opposition 22m (Table 10). Differences were found between the phases ($\chi^2(2)=32.71$, $p<0.001$, Phi=0.13) with more errors in Phase 1-3 (standardised residual: 4.47) and less errors in Phase 7+ (standardised residual: -3.39). Within phase 1-3 ($\chi^2(4)=69.35$, $p<0.001$, Phi=0.24) and phase 4-6 ($\chi^2(4)=26.57$, $p<0.001$, Phi=0.19), the case team had more 'Turnover Hand' within the attacking 22m (standardised residual: 7.38 and 3.78 respectively).

Table 10: Comparison of the type of errors made at the end of phase play in the oppositions' 22m zone (Red Zone) that has prevented a try being scored (frequency and percentage)

	Frequency of errors during Phase 1-3 (% Overall Errors)	Frequency of errors during Phase 4-6 (% Overall Errors)	Frequency of errors during Phase 7+ (% Overall Errors)	Total
Turnover Contact	10 37%	11 41%	6 22%	27 21%
Turnover Hand	42 60%	17 24%	11 16%	70 56%
Turnover Kick	4 36%	4 36%	3 28%	11 9%
Turnover Touch	7 78%	2 22%	0 0%	9 7%
Turnover Other	8 89%	1 11%	0 0%	9 7%
Total	71 56%	35 28%	20 16%	126

4.9. Type of Penalty Awarded preventing a Try being Scored

The case team (Table 11) were awarded more penalties than they conceded (n=51 vs. n=20; $\chi^2(1)=13.54$, $p<0.001$, Phi=0.19). There were differences in phase number and Penalty/FK For ($\chi^2(2)=19.18$, $p<0.001$, Phi=01.8) with more penalties being awarded to the case team during Phase 1-3 (standardised residual: 3.40).

Table 11: Frequency and percentage of penalties/free kicks awarded and conceded per phase when the case team enters opposition 22m zone (Red Zone) that has prevented a try being scored

	Frequency of penalties during Phase 1-3 (% Overall Penalties)	Frequency of penalties during Phase 4-6 (% Overall Penalties)	Frequency of penalties during Phase 7+ (% Overall Penalties)	Total
Penalty/FK For	31 61%	14 28%	6 12%	51 72%
Penalty/FK Conceded	7 35%	8 40%	5 25%	20 28%

4.10. Tries Scored by Origin of Possession and Pitch Location

From the match sample the tries scored by the case team (Table 12) differed by origin of possession ($\chi^2(4)=10.38$, $p<0.05$, Phi=0.04) with more tries from 'Lineout' (standardised residual: 2.85). Similarly, the number of tries scored by the opposition differed by origin of possession ($\chi^2(4)=12.29$, $p<0.05$, Phi=0.1) with more tries from 'Lineout' (standardised residual: 2.28) and less tries from 'Penalty' (standardised residual: -2.25).

Differences were found between origin of possession and pitch location in the 'Attacking 0-50m Zone' for the case team ($\chi^2(4)=12.84$, $p<0.05$; Monte Carlo Test, p=0.014, Phi=0.2) with more tries from 'Lineout' (standardised residual: 3.18). Similarly, the number of tries scored in the 'Attacking 22m-Try Line Zone' differed

for the case team ($\chi^2(4)=10.14$, $p<0.05$, Phi=0.1) with less tries from 'Kick Reception' (standardised residual: -1.99). Overall the case team and their opposition scored more tries in the attacking 22m to try-line zone ($n=43$) and the least amount of tries scored was in the defensive 0-50m zone ($n=26$).

Table 12: Pitch location and behavioural origin (possession) of all tries scored and conceded by the case team and their respective opposition (frequency and percentage of total for the case team and opposition)

	Defensive 0–50 Meters (Zone Red & Blue)		Attacking 22–50 Meters (Zone Yellow)		Attacking 22 Meter–Try line (Zone Green)		Total	
	Case Team	Opposition	Case Team	Opposition	Case Team	Opposition	Case Team	Opposition
Kick Reception	7 11%	5 12%	2 3%	3 7%	1 2%	1 2%	**10** **16%**	**9** **21%**
Scrum	-	-	2 3%	-	9 14%	7 17%	**11** **17%**	**7** **17%**
Lineout	3 5%	2 5%	10 16%	10 24%	10 16%	3 7%	**23** **37%**	**15** **36%**
Penalty	3 5%	-	3 5%	-	3 5%	1 2%	**9** **15%**	**1** **2%**
Turnover	3 5%	3 7%	2 3%	5 12%	6 9%	2 5%	**11** **17%**	**10** **24%**
Total	**16** **25%**	**10** **24%**	**19** **30%**	**18** **43%**	**29** **45%**	**14** **33%**	**64**	**42**

5. Discussion

This thesis aim examined the predictors of success (tries scored) within a professional rugby union team across an entire Domestic and European season. This was achieved through two objectives. First the examination of technical variables related to the contact area/tackle contest (e.g. strength in tackle, ball placement & tackle clearance) and related factors (e.g., possession, phases, gainline & speed of ball) was considered to identify characteristics associated with being dominant in the tackle contest and maintaining possession of the ball. The second objective investigated tactical behaviours (i.e., pitch location and origin of possession) in relation to try scoring. Specifically, to identify the location on the field where the try originated from, and whether the case team was more successful than the opposition in scoring tries from a particular area.

To investigate the thesis objectives, team performance profiles relating to success in rugby union were analysed using frequency, percentage data (Hughes & Bartlett, 2002) and statistical techniques to determine whether distributions of variables differed from one another (Hughes et al., 2002). Although the existing literature has documented the factors that are associated with successful performance and try scoring (e.g., Hughes & White, 1997; Jones et al., 2004; Laird & Lorimer, 2004) no research has incorporated all aspects (i.e., specific rugby skills such as ball carries, tackle contest which have lead to tries and try scoring opportunities) of rugby union to identify the successful attributes to try scoring.

5.1. Technical Indicators of the Tackle Contest for Tries Scored

Long and Hughes (2004) and Eaves and Hughes (2003) reported that the nature of rugby union has changed to a faster-paced game since professionalization with more

ruck-dominated contests. The findings presented in this study have shown that players from the case team were tackled (tackle occurs when the ball carrier is held by one or more opponents and is brought to ground, IRB 2008) on more occasions than their opposition. van Rooyen et al. (2010) identified that a team creating more rucks would be likely to score more points than their opposition and therefore win the game. This study supports the assumptions made by van Rooyen et al. as the case team scored more tries and created more rucks than their opposition. Potter and Carter (2001) described a similar relationship with winning teams having a higher percentage of rucks in their analysis international level teams.

Attacking players are currently seen to deliberately engage in contact with the opponents to reduce the number of defenders for the next move (Quarrie & Hopkins, 2007). Therefore, it has been emphasised that when teams enter the tackle contest it is important to retain the ball. The results of this thesis have shown that the ball carrier is stronger in the contact than the defence as the case team and their opposition have more incidences in 'Going Forward' in the contact. McKenzie et al. (1989) identified that low body height and strong leg drive is a good technique to dominate the tackle contest. In addition, Wheeler and Sayers (2009) showed that when the ball carrier displayed high body height the defence turned the ball over at the breakdown. This is potentially why turnover contact is the second highest turnover type displayed by the case team. However, more research is required to identify if 'Going Forward' in the tackle contest has a positive outcome such as a line-break, tackle-break or an offload, as this can also have an influence on match performance (Wheeler & Sayers, 2009).

When the ball carrier is advancing the line in contact, the players have more control of the ball and therefore can place the ball at the back of the tackle contest

ready for the acting scrum-half (Johnson, 2008). Players have adopted the 'Arm Extended' method on more occasions than 'Squeeze' and 'Poor'. Biscombe and Drewett (1998) explained that keeping the ball away from the defence allows a dynamic and fast ruck to produce an early ball which in turn allows the team to launch an attack against an unorganised defence.

5.2. Possession and Tries Scored per Phase

It was hypothesised that more tries would be scored during the first three phases by the case team and their opposition. The findings concurred with the hypothesis and showed that the majority of possession and tries scored for the case team and their opposition were during phase one and two, whilst possession and tries during phase eight, nine and ten were less. Lim et al. (2011) found that 67% of try scoring occurred from three Team Attacking Superiority (TAS) periods or less (TAS is a scoring system that could predict try scoring in rugby union), hence it appears easier for a team to sustain attacking dominance with the likelihood of converting the possession into points. On the other hand, Lim et al. also explained that increasing the number of passes would either force the team to make mistakes or increase the chance of the opposition to create a turnover due to good defensive skills. The findings in the present thesis regarding the number of errors and penalties the case team conceded in the attacking 22m zone that prevented a try being scored show that the majority of errors and penalties occurred within the first three phases. Subsequently, there is a higher probability to score tries through higher number of phases (Hughes & Franks, 2005). The likelihood of scoring points would increase if the attacking team sustained higher number of TAS periods (Lim et al., 2011).

The findings of this thesis, and those of extant rugby research, relating to the number of tries scored in each phase of possession has parallels with findings in other invasion games. For example, within association football, Reep and Benjamin (1968) reported that 80% of goals originated from possession of three or fewer passes. This reflects the findings of this thesis where the majority of tries (67% for the case team and 57% for the opposition) were scored from possession comprising three or fewer phases. However, when consideration is given to the total number of possessions with a given phase length (see Table 7) it is evident that possession with more phases can be as effective in producing tries as the shorter possessions. This replicates the findings of Hughes and Franks (2005) who argue that the data of Reep and Benjamin (1968) was methodologically flawed and used data from World Cup association football to show that longer possessions (i.e. more passes) were no less effective in producing goals.

5.3. Team Gainline during Tries Scored

It was hypothesised that the more gainline made by the case team the more likely a try would be scored. Whether a team can successfully or unsuccessfully break through their opposition defensive line can determine the outcome of a rugby match (Sayers & Washington-King, 2006). The results of the current study indicate that during the phases of play 'Gainline +' is the main indicator for a team gainline when a try has been scored. Wheeler et al. (2010) emphasised that line breaks were associated with scoring tries in the next phase, but during this study 'Gainline Break' was one of the indicators with low percentages in relation to try scoring. Although 'Gainline Break' has a small percentage against their opposition the success rate is

high (65%). Diedrick et al. (2011) stated although line-breaks are effective way in scoring tries it does not necessarily win the team matches.

5.4. Speed of Ball during Tries Scored

When the ball becomes available from the tackle contest it was hypothesised that quicker the speed of ball there is an increased opportunity to score. The time it takes for the ball to become available when the ball carrier has gone to ground affects the ability of the team to attack (Johnson, 2008). Prim et al. (2006) stated that a 'quick ball' from the tackle contest usually takes less than three seconds and reduces the time the defensive team have to organise for the next phase, thus providing gaps, or weak inside shoulders for the attacking team to take advantage of. However, when the performance indicators were being agreed with the coaches and analysts 'quick ball' was defined as less than 2.5 seconds, therefore the attacking team will have a greater chance of playing against an unorganised defence and increase the chance of making gainline and scoring tries.

During this thesis quick and average speeds of ball have higher frequencies but the slow ball was higher during phase 1-3 for the opposition and quick ball was higher for the case team. Overall, during phase 4-6 and 7+ no differences were found between the case team and their opposition. As a result, 'quick' speed of ball is not a specific characteristic of try scoring for the case team as the opposition teams' also displayed similar characteristics. It may be suggested that the case team may have a higher tempo of play and the style of attack is the key to scoring more tries than their opposition, therefore it is not always necessary to have 'quick ball' from the tackle contest and maybe it is over-emphasised in existing coaching manuals (Johnson, 2008) and through rugby commentary.

5.5. Pitch Locations and Origin of Tries Scored and Conceded

In this study, it was hypothesised that possession gained within the opponents half and from Lineout was a predictor of try scoring. The results indicated that 76% of tries originated within the opponents half (yellow and green zones) and 41% of those tries were scored from possession gained within the opponents 22m line (zone green). Laird and Lormier (2004) found that 75% of tries came from possession gained within the opponents half and 39% of tries came from possession gained within the 22m line. However, it is not surprising that the number of tries scored is higher within the 22m area as it is the closest sector of the field to the try line. Therefore, it is difficult to identify and make recommendations on what type of play is more effective. Consequently, during this study further analysis was conducted on the origin of possession to identify if it has any influence on try scoring.

The analysis conducted in this study showed that tries were predominantly scored from 'Lineout' (37% by case team and 36% by opposition) and 'Turnover' (17% by case team and 24% by the opposition). Although, the statistics were similar for the case team and the opposition it was unexpected to find that the case team conceded more tries from possession gained from Lineout and Turnover in the 'Attacking 50-22m' area (Zone Yellow) than the '22m to try line' area (Zone Green). Sasaki et al. (2007) reported that more tries were scored from lineouts, scrum and tackle turnover. With teams scoring 20% of tries from turnover, this may be as a result of a strong defensive system, specifically when possession is gained from turnover in the opponents half it can increase the chance of a try being scored (Laird & Lorimer, 2004; Sasaki et al., 2007). This may be the reason why the case team has conceded more tries from the 50m to 22m area.

5.6. Summary

Overall the results of the technical indicators for the case team and the opposition have shown that more tries are scored during phase one and two. The results suggest that during each phase teams are required to be stronger in the tackle contest by 'Going Forward', presenting the ball away from the contact (arm extended) and ensuring supporting players are securing the ball by using the 'Inside/Outside clean' method to be successful. Finally, team Gainline was another important factor for the case team and their opposition in scoring tries with 'Gainline +' being most effective. With regard to the tactical indicators, the findings have shown that scoring tries were more successful from gaining possession from the opponents' half for the case team. Therefore, gaining possession closer to the try line increase the opportunity to score. Overall, tries were predominantly scored from 'Lineout' and 'Turnover' by the case team and their opposition, however the case team conceded more tries from the 50-22m zone.

5.7. Limitations and Future Directions

Although this study has identified the variables, and thus performance profile, that are associated with try scoring, it may be beneficial to examine how this profile is influenced by the specific defensive structures that were employed by teams (e.g., man on man, blitz and drift defence). Future research within try scoring should continue to look at specific rugby skills that lead to try scoring opportunities in particular the tackle contest and the events which occur around the contact such as tackle and line breaks (Sayers & Washington-King, 2005) but also examine defensive performances (e.g., missed tackles, numbers in defensive tackle contest,

turnovers) as Sasaki et al. (2007) suggested that defence is critical to the success of a team.

The analyses used in this thesis were frequency and percentages with chi-square tests of significance. This was complemented with the analysis of standardised residuals and Phi to specifically determine the differences between observed and expected frequencies. Additionally, to account for the sparseness' of data the Monte Carlo test (including simulated *p* values) were used.

Although these procedures were appropriate for the data analysis carried out in this study, it is acknowledged that future study could extend the research by using longlinear modelling to examine higher-order interactions of variables (see Nevill, Atkinson, Hughes & Cooper, 2002) such as analysing three or more categorical variables (e.g., for this study we could have analysed speed of ball versus phase 1-3, phase 4-6 and phase 7+ rather than just analsying speed of ball versus 1 type of phase). Logistical regression/logit modeling (see Taylor, Mellalieu, James & Barter, 2010; Taylor, Mellalieu, James & Shearer, 2008) could also be used to determine the prediction of an outcome variable (e.g. tries scored) as a function of a given situation (e.g., match played at home, against stronger opposition etc). While there are advantages to using such techniques these are potentially outweighed by the need for large datasets. Given that this study was restricted to match footage provided by the case team it was not possible to increase the sample size. Even if additional match footage could have been accessed this would have been from a different season and introduce additional complications such as player turnover and changes to training, tactics etc that may lead to differences in performance between seasons (e.g. see O'Donoghue, 2001; Taylor et al. 2010).

Additional limitations that should also be considered for future research are the influence of environmental conditions. The weather and the condition of the pitch can affect the way teams play and can influence the running, passing and kicking strategies of the game (e.g. Thein, 1995; Lee & Garraway, 2000; Laird & Lorimer, 2004). Future research should therefore seek to examine technical/tactical rugby performance indicators by considering the weather and pitch conditions and how would this affect the number of rucks, handling errors, ball in play time and how points are scored.

During this study a case team was examined in detail compared with an aggregated dataset comprising their opposition. By compiling all the opponents' information together it is difficult to identify the different styles of play teams use. Therefore, in the future it may be better to consider all the teams within the Domestic/European competition individually (Jones, James & Mellalieu, 2008). This will provide additional information on how the variables differ between each team (i.e., identify how the case team play compared to a specific opposition team rather than comparing the case team and an amalgamation of all other teams they played). For example, Garganta, Maia and Basto (1997) utilised this approach in football, where five European teams were observed and hand-notated. The analysis was conducted separately for each category of observation as Porto and Barcelona had between 11 and 16 games while the other team only had 5 to 7 games. Although the data sample was small, the study was able to provide specific characteristics for each team. However, despite these results, this approach to data analysis remains the exception of the rule in research literature relating to team-based invasion games.

Finally, during the reliability study one match was used to test the accuracy and validity of the system. Although 100% was reached for intra-observer

agreement, this result may be flawed because the number of actions coded for each variable may have been limited. Therefore it is suggested that more games are used during the reliability testing to ensure that all variables are tested appropriately (Hughes, 2004).

5.8. Practical Implications

From a practical perspective, the results relating to possession and phases indicate that majority of tries were scored within the first three phases which concurs with the results by Laird and Lorimer (2004). However, the number of turnovers and penalties were also the highest during the first three phases. Indeed this is a common view that the majority of possessions are likely to also consist of relatively few phases (Hughes & Franks, 2005). Nonetheless, this may suggest that if the attacking team can sustain possession without conceding turnovers the defensive team could fatigue under pressure, which will then result in points being scored. This could have implications for the development of training programmes with coaches ensuring that sessions are at high intensity and defending for long periods so that players are able to manage the pressure and also have the fitness to keep defending.

The technical indicators of the tackle contest prior to tries being scored has shown that 'Going Forward' in the tackle, presenting the ball away from the defence (arm extended) and clearing defensive players from the ruck (inside and outside clean) are all effective methods for retaining the ball. As a result, coaches should focus on training the correct technique as stated by McKenzie et al. (1989). Specifically, low body height and strong leg drive is a good technique to implement to help dominate the tackle contest and therefore, more likely to win matches (van Rooyen et al., 2010).

The findings related to pitch location of tries and origins of possession suggest that many tries were scored from turnover within the attacking half of the pitch. From a practical perspective, teams need to spend less time within their half of the field as turnover situations can change the competitiveness and continuity dynamics of the rugby game (Sasaki et al., 2007). This may be achieved by having a strong kicking game, if teams are able to kick the ball into the attacking half of the field more time would be spent near the try line, which can then increasing scoring opportunities. As large differences were found from lineout and turnover possession, emphasis should be placed on the coaching the attack and defence of these areas in future training sessions.

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Appendices

Appendix 1 – Intra-reliability on the 1st occasion by the author.

	A	B	C	D	E	F	G	H	I
1	category	Nth instance	descriptors	descriptors					
2	Zone 1 Green	1	1	From Lineout					
3	P1	1	3	Gainline -	1 Static	Penalty/TK For			
4	Zone 1 Green	2	1	From Penalty					
5	P1	2	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
6	P2	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
7	P3	1	5	Gainline 0	1 Going Fwd	3 Inside Clean	3 Outside Clean	4 Average	
8	P4	1	6	Gainline -	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
9	P5	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
10	P6	1	1	Turnover Kick					
11	Zone 2 Yellow	1	1	From Lineout					
12	P1	3	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
13	P2	2	1	Turnover Kick					
14	Zone 2 Yellow	2	1	From Lineout					
15	P1	4	1	Penalty/TK For					
16	Zone 3 Blue	1	1	From Lineout					
17	P1	5	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
18	P2	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
19	P3	2	2	Turnover Kick	Gainline Break				
20	Zone 1 Green	3	1	From Lineout					
21	P1	6	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	Penalty/TK For
22	Zone 1 Green	4	1	From Lineout					
23	P1	7	3	Gainline 0	1 Retreating	Turnover Touch			
24	Zone 2 Yellow	3	1	From Lineout					
25	P1	8	2	1 Static	Turnover Touch				
26	Zone 2 Yellow	4	1	From Turnover					
27	P1	9	6	Gainline + Pener	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
28	P2	4	1	Turnover Hand					
29	Zone 1 Green	5	1	From Lineout					
30	P1	10	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
31	P2	5	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
32	P3	3	4	Gainline -	1 Static	Penalty/TK Conceded	Turnover Contact		
33	Zone 3 Yellow	5	1	From Turnover					
34	P1	11	6	Gainline Break	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
35	P2	6	4	Gainline -	1 Going Fwd	3 Outside Clean	4 Average		
36	P3	4	5	Gainline +	1 Going Fwd	2 Arm Extend	3 Outside Clean	4 Quick	
37	P4	2	2	Penalty/TK For	Gainline 0				
38	Zone 1 Green	6	1	From Scrum					
39	P1	12	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
40	P2	7	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
41	P3	5	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
42	P4	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
43	P5	2	3	Gainline -	1 Static	Penalty/TK For			
44	Zone 4 Red	1	1	From Kick Reception					
45	P1	13	2	Gainline Break	TRY				
46	Zone 2 Yellow	6	1	From Scrum					
47	P1	14	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
48	P2	8	4	Gainline Break	1 Static	2 Arm Extend	4 Quick		
49	P3	6	4	Gainline +	1 Static	2 Arm Extend	4 Quick		
50	P4	4	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
51	P5	3	1	TRY					
52	Zone 1 Green	7	1	From Lineout					
53	P1	15	2	Gainline +	TRY				
54	Zone 1 Green	8	1	From Lineout					
55	P1	16	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
56	P2	9	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
57	P3	7	2	Gainline +	TRY				
58	Zone 3 Blue	2	1	From Turnover					
59	P1	17	6	Gainline -	1 Retreating	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
60	P2	10	2	Gainline Break	TRY				
61	Zone 2 Yellow	7	1	From Lineout					
62	P1	18	2	Gainline Break	TRY				
63	Zone 1 Green	9	1	From Scrum					
64	P1	19	2	Gainline +	1 Going Fwd				
65	P2	11	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
66	P4	5	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
67	P5	4	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
68	P6	2	2	Gainline +	TRY				
69	Zone 1 Green	10	1	From Lineout					
70	P1	20	2	Gainline Break	TRY				
71	Zone 2 Yellow	8	1	From Lineout					
72	P1	21	2	Gainline Break	TRY				
73									

Appendix 2 – Intra-reliability on the 2nd occasion by the author.

	A	B	C	D	E	F	G	H	I
1	category	Nth instance	descriptors	descriptors					
2	Zone 1 Green	1	1	From Lineout					
3	P1	1	3	Gainline -	1 Static	Penalty/TK For			
4	Zone 1 Green	2	1	From Penalty					
5	P1	2	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
6	P2	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
7	P3	1	5	Gainline 0	1 Going Fwd	3 Inside Clean	3 Outside Clean	4 Average	
8	P4	1	6	Gainline -	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
9	P5	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
10	P6	1	1	Turnover Kick					
11	Zone 2 Yellow	1	1	From Lineout					
12	P1	3	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
13	P2	2	1	Turnover Kick					
14	Zone 2 Yellow	2	1	From Lineout					
15	P1	4	1	Penalty/TK For					
16	Zone 3 Blue	1	1	From Lineout					
17	P1	5	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
18	P2	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
19	P3	2	2	Turnover Kick	Gainline Break				
20	Zone 1 Green	3	1	From Lineout					
21	P1	6	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	Penalty/TK For
22	Zone 1 Green	4	1	From Lineout					
23	P1	7	3	Gainline 0	1 Retreating	Turnover Touch			
24	Zone 2 Yellow	3	1	From Lineout					
25	P1	8	2	1 Static	Turnover Touch				
26	Zone 2 Yellow	4	1	From Turnover					
27	P1	9	6	Gainline + Penet	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
28	P2	4	1	Turnover Hand					
29	Zone 1 Green	5	1	From Lineout					
30	P1	10	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
31	P2	5	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
32	P3	3	4	Gainline -	1 Static	Penalty/TK Conceded	Turnover Contact		
33	Zone 2 Yellow	5	1	From Turnover					
34	P1	11	6	Gainline Break	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
35	P2	6	4	Gainline -	1 Going Fwd	3 Outside Clean	4 Average		
36	P3	4	5	Gainline +	1 Going Fwd	2 Arm Extend	3 Outside Clean	4 Quick	
37	P4	2	2	Penalty/TK For	Gainline 0				
38	Zone 1 Green	6	1	From Scrum					
39	P1	12	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
40	P2	7	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
41	P3	5	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
42	P4	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
43	P5	2	3	Gainline -	1 Static	Penalty/TK For			
44	Zone 4 Red	1	1	From Kick Reception					
45	P1	13	2	Gainline Break	TRY				
46	Zone 2 Yellow	6	1	From Scrum					
47	P1	14	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
48	P2	8	4	Gainline Break	1 Static	2 Arm Extend	4 Quick		
49	P3	6	4	Gainline +	1 Static	2 Arm Extend	4 Quick		
50	P4	4	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
51	P5	3	1	TRY					
52	Zone 1 Green	7	1	From Lineout					
53	P1	15	2	Gainline +	TRY				
54	Zone 1 Green	8	1	From Lineout					
55	P1	16	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
56	P2	9	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
57	P3	7	2	Gainline +	TRY				
58	Zone 3 Blue	2	1	From Turnover					
59	P1	17	6	Gainline -	1 Retreating	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
60	P2	10	2	Gainline Break	TRY				
61	Zone 2 Yellow	7	1	From Lineout					
62	P1	18	2	Gainline Break	TRY				
63	Zone 1 Green	9	1	From Scrum					
64	P1	19	2	Gainline +	1 Going Fwd				
65	P2	11	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
66	P4	5	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
67	P5	4	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
68	P6	2	2	Gainline +	TRY				
69	Zone 1 Green	10	1	From Lineout					
70	P1	20	2	Gainline Break	TRY				
71	Zone 2 Yellow	8	1	From Lineout					
72	P1	21	2	Gainline Break	TRY				
73									

Appendix 3 – Inter-reliability by the author

	A	B	C	D	E	F	G	H	I
1	category	Nth instance	descriptors	descriptors					
2	Zone 1 Green	1	1	From Lineout					
3	P1	1	3	Gainline -	1 Static	Penalty/TK For			
4	Zone 1 Green	2	1	From Penalty					
5	P1	2	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
6	P2	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
7	P3	1	5	Gainline 0	1 Going Fwd	3 Inside Clean	3 Outside Clean	4 Average	
8	P4	1	6	Gainline -	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
9	P5	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
10	P5	1	1	Turnover Kick					
11	Zone 2 Yellow	1	1	From Lineout					
12	P1	3	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
13	P2	2	1	Turnover Kick					
14	Zone 2 Yellow	3	1	From Lineout					
15	P1	4	1	Penalty/TK For					
16	Zone 3 Blue	1	1	From Lineout					
17	P1	5	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
18	P2	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
19	P3	2	2	Turnover Kick	Gainline Break				
20	Zone 1 Green	3	1	From Lineout					
21	P1	6	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	Penalty/TK For
22	Zone 1 Green	4	1	From Lineout					
23	P1	7	3	Gainline 0	1 Retreating	Turnover Touch			
24	Zone 2 Yellow	3	1	From Lineout					
25	P1	8	2	1 Static	Turnover Touch				
26	Zone 2 Yellow	4	1	From Turnover					
27	P1	9	6	Gainline + Penet	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
28	P2	4	1	Turnover Hand					
29	Zone 1 Green	5	1	From Lineout					
30	P1	10	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
31	P2	5	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
32	P3	3	4	Gainline -	1 Static	Penalty/TK Conceded	Turnover Contact		
33	Zone 2 Yellow	5	1	From Turnover					
34	P1	11	6	Gainline Break	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
35	P3	6	4	Gainline -	1 Going Fwd	3 Outside Clean	4 Average		
36	P3	4	5	Gainline +	1 Going Fwd	2 Arm Extend	3 Outside Clean	4 Quick	
37	P4	2	2	Penalty/TK For	Gainline 0				
38	Zone 1 Green	6	1	From Scrum					
39	P1	12	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
40	P2	7	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
41	P3	5	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
42	P4	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
43	P5	2	3	Gainline -	1 Static	Penalty/TK For			
44	Zone 4 Red	1	1	From Kick Reception					
45	P1	13	2	Gainline Break	TRY				
46	Zone 2 Yellow	6	1	From Scrum					
47	P1	14	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
48	P2	8	4	Gainline Break	1 Static	2 Arm Extend	4 Quick		
49	P3	6	4	Gainline +	1 Static	2 Arm Extend	4 Quick		
50	P4	4	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
51	P5	3	1	TRY					
52	Zone 1 Green	7	1	From Lineout					
53	P1	15	2	Gainline +	TRY				
54	Zone 1 Green	8	1	From Lineout					
55	P1	16	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
56	P2	9	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
57	P3	7	2	Gainline +	TRY				
58	Zone 3 Blue	2	1	From Turnover					
59	P1	17	6	Gainline -	1 Retreating	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
60	P2	10	2	Gainline Break	TRY				
61	Zone 2 Yellow	7	1	From Lineout					
62	P1	18	2	Gainline Break	TRY				
63	Zone 1 Green	9	1	From Scrum					
64	P1	19	2	Gainline +	1 Going Fwd				
65	P2	11	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
66	P4	5	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
67	P5	4	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
68	P5	2	2	Gainline +	TRY				
69	Zone 1 Green	10	1	From Lineout					
70	P1	20	2	Gainline Break	TRY				
71	Zone 2 Yellow	8	1	From Lineout					
72	P1	21	2	Gainline Break	TRY				
73									

Appendix 4 – Inter-reliability by the 2nd coder (discrepancy highlighted in yellow)

	A	B	C	D	E	F	G	H	I
1	category	Nth instance	descriptors	descriptors					
2	Zone 1 Green	1	1	From Lineout					
3	P1	1	3	Gainline -	1 Static	Penalty/TK For			
4	Zone 1 Green	2	1	From Penalty					
5	P1	2	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
6	P2	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
7	P3	1	5	Gainline 0	1 Going Fwd	3 Inside Clean	3 Outside Clean	4 Average	4 Quick
8	P4	1	6	Gainline -	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
9	P5	1	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
10	P6	1	1	Turnover Kick					
11	Zone 2 Yellow	1	1	From Lineout					
12	P1	3	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
13	P2	2	1	Turnover Kick					
14	Zone 2 Yellow	2	1	From Lineout					
15	P1	4	1	Penalty/TK For					
16	Zone 3 Blue	1	1	From Lineout					
17	P1	5	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
18	P2	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
19	P3	2	2	Turnover Kick	Gainline Break				
20	Zone 1 Green	3	1	From Lineout					
21	P1	6	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	Penalty/TK For
22	Zone 1 Green	4	1	From Lineout					
23	P1	7	3	Gainline 0	1 Retreating	Turnover Touch			
24	Zone 2 Yellow	3	1	From Lineout					
25	P1	8	2	1 Static	Turnover Touch				
26	Zone 2 Yellow	4	1	From Turnover					
27	P1	9	6	Gainline + Penet	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
28	P2	4	1	Turnover Hand					
29	Zone 1 Green	5	1	From Lineout					
30	P1	10	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
31	P2	5	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
32	P3	3	4	Gainline -	1 Static	Penalty/TK Conceded	Turnover Contact		
33	Zone 2 Yellow	5	1	From Turnover					
34	P1	11	6	Gainline Break	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
35	P2	6	4	Gainline -	1 Going Fwd	3 Outside Clean	4 Average		
36	P3	4	5	Gainline +	1 Going Fwd	2 Arm Extend	3 Outside Clean	4 Quick	
37	P4	2	2	Penalty/TK For	Gainline 0				
38	Zone 1 Green	6	1	From Scrum					
39	P1	12	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
40	P2	7	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
41	P3	5	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
42	P4	3	6	Gainline 0	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
43	P5	2	3	Gainline -	1 Static	Penalty/TK For			
44	Zone 4 Red	1	1	From Kick Reception					
45	P1	13	2	Gainline Break	TRY				
46	Zone 2 Yellow	6	1	From Scrum					
47	P1	14	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
48	P2	8	4	Gainline Break	1 Static	2 Arm Extend	4 Quick		
49	P3	6	4	Gainline +	1 Static	2 Arm Extend	4 Quick		
50	P4	4	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
51	P5	3	1	TRY					
52	Zone 1 Green	7	1	From Lineout					
53	P1	15	2	Gainline +	TRY				
54	Zone 1 Green	8	1	From Lineout					
55	P1	16	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
56	P2	9	6	Gainline +	1 Going Fwd	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Slow
57	P3	7	2	Gainline +	TRY				
58	Zone 3 Blue	2	1	From Turnover					
59	P1	17	6	Gainline -	1 Retreating	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
60	P2	10	2	Gainline Break	TRY				
61	Zone 2 Yellow	7	1	From Lineout					
62	P1	18	2	Gainline Break	TRY				
63	Zone 1 Green	9	1	From Scrum					
64	P1	19	2	Gainline +	1 Going Fwd				
65	P2	11	6	Gainline +	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Quick
66	P4	5	6	Gainline 0	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
67	P5	4	6	Gainline -	1 Static	2 Arm Extend	3 Inside Clean	3 Outside Clean	4 Average
68	P6	2	2	Gainline +	TRY				
69	Zone 1 Green	10	1	From Lineout					
70	P1	20	2	Gainline Break	TRY				
71	Zone 2 Yellow	8	1	From Lineout					
72	P1	21	2	Gainline Break	TRY				
73	Zone 2 Yellow	8	1	From Lineout					
74	P1	21	2	Gainline Break	TRY				